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PINEAPPLE

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Notes

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1. Presentation

1.1. Origins; early trading history

Botany

The pineapple is part of the Bromeliaceae family. The cultivated types belong to the genus *Ananas*, which covers several species, the most familiar of which, exploited for commercial purposes, is *Ananas comosus*. The main cultivars have been listed in five groups defined by the plant habit, fruit shape, flesh characteristics and leaf morphology and have been spread worldwide where they have been able to adapt to local pedoclimatic conditions:

1- Cayenne	2- Spanish
3- Queen	4- Pernambuco
5- Perolera	

The plant and fruit

The pineapple is a herbaceous plant spanning from 1.0 to 1.50 metres in both height and circumference. It is formed by a sheath of thick, lanceolate leaves which may be more or less spiny, arranged around a stem which forms the axis of the plant. This extends into a scape, the top of which bears the fruit surmounted by a crown. The inflorescence comprises a cluster which can contain more than a hundred flowers. The fruit actually consists of flowers growing around the scape, which go on to form the fruit stem, from the stalk to the crown. Each flower gives rise to an independent fruit arranged in a spiral around the stem. These fruits merge during fruit-bearing to produce the pineapple. The set fruits have an external covering of thick scales, known as the "eyes"¹.

Since the pineapple produces few seeds, it is reproduced, particularly for industrial planting, by means of sprouts produced by the plant after fruit-bearing. This process is being increasingly supplanted by use of vitroplants, which frees planters from plant stock limitations, and helps ensure crop homogeneity.

Origins

The various pineapple species seems to have originated from South America, and more particularly from a large area encompassing Brazil, northern Argentina and Paraguay. The fruit probably originated from the basins of the Rivers Parana and Paraguay. This area does not exclude wider

dissemination of wild pineapple species, in particular as far as Venezuela. Trade in the best fruits for consumption between tribes in this original zone seems to have enabled them to gradually spread toward Central America and the Caribbean.

Its discovery by the Western world can be precisely dated. In his second expedition to the Americas, Christopher Columbus landed on a Caribbean island where he encountered the fruit for the first time.

The pineapple was disseminated as the main sea routes were opened up by the Portuguese and Spanish during the 16th Century. Its presence was recognised on Saint Helena in 1505, the Indies in 1545 and Madagascar in 1548. It then appeared in Asia in the second half of the 16th Century. In the late 17th Century, the pineapple had established itself across the whole tropical zone. The fruit reached Europe from 1535, brought back to Spain by sailors, and was presented as a curiosity in the various courts of Europe, either fresh or crystallised. In the late 17th Century to early 18th Century, some greenhouse production attempts were undertaken in England and France, but without much success. The pineapple was introduced late to Hawaii at the end of the 18th Century, and the United States became the leading pineapple supplier in the early 20th Century¹.

Producers tried to ship fresh pineapple by sea, but they were quickly stymied by the perishability of the product, and these shipping attempts were rapidly aborted. Hence exports were only made over short, well-served distances, particularly around Florida, a major production zone in the early 20th Century that soon found itself in competition with Cuba, Puerto Rico and the Bahamas. In Western Europe, after the attempts at greenhouse production of previous centuries, the pineapple was established on the Azores, Europe's leading supplier until the Second World War.

The first canning tests go back to 1882 in Hawaii. At the turn of the 20th Century, and until the 1920s, pineapple canneries developed in Asia (Taiwan, South-East Asia and Malaysia), and then in Australia and South Africa. They were also set up in the Philippines and Kenya. Production grew steeply until the Second World War, with the rise of the canning industry. The trade in fresh fruits also increased, though it remained restricted to the consumption centres close to production areas.

The real boom in pineapple production and trade came in the post-Second World War period, in tandem with increased demand and the

¹ PY C., Lacoeyuilhe JJ., Teisson C. (1984). *L'ananas: sa culture, ses produits*, Maisonneuve et Larose, France.

development of refrigerated transport. From then on we saw a surge in production no longer limited to the Caribbean and the United States, and to a lesser degree Asia, but which rapidly expanded and intensified in Asia and Africa.

1.2. Cultivation, harvesting, processing, from transport to consumer

Cultivation

The pineapple is a perennial herbaceous plant, whose root system remains close to the surface. It is reproduced vegetatively. The sprouts (or slips) produced by the plant after fruit-bearing are used for replanting. The crowns can also be used for plant reproduction, but this process is slower and less productive. While in the natural state the pineapple can produce several fruits over successive production cycles, industrial production requires new plant stock to be planted after each production cycle. Depending on pedoclimatic conditions and the varieties, a cycle extends on average over 14 to 20 months with three stages:

- sprouts planted and grown (6 to 7 months);
- flowering until harvest (5 to 6 months);
- sprout production for replanting (3 to 6 months).

The main condition for pineapple cultivation is the temperature of the production zones, which may not be less than approximately 25°C, to ensure normal plant growth and fruit-bearing. Its water requirements are moderate, which explains the distribution of plantations across all the intertropical zones. Nonetheless, a regular water supply is preferable for good plant development. The pineapple is well adapted to zones with short daylight hours, with a low variation between daytime and night time temperatures. Given its small root system, the pineapple proliferates better in light, aerated and well-drained soils, with pH 4.5 to 5.5. Though fairly undemanding, the pineapple plant does still need fertilisers to ensure good fruit production¹.

The pineapple is generally planted on low ridges or beds favourable to drainage and planting operations. In certain cases, the ridges are covered with polyethylene films which promote root development by raising the soil temperature, limit precipitation damage and reduce weed proliferation. Conversely, this method is costly, produces a lot of synthetic material waste and creates conditions favourable for development of parasites, etc. Pineapple plants are generally arranged in two or three staggered parallel rows on each ridge. The average plant separation is 25 to 30 cm, and the

row separation approximately 80 cm. These are only average data, since they can vary according to planting density, which ranges from 50 000 to 70 000 plants/hectare. Planting density is one of the parameters influencing plant development and fruit size upon harvesting. The lowest densities are preferable in less sunny zones. Conversely, high densities will be more recommended in zones of more intense sunshine. Given the restricted and fragile root system, the sprouts are planted at a depth of around ten centimetres, without a drilling movement which could damage the roots.

Pineapple cultivation is plannable, which is one of its major characteristics. Depending on the pedoclimatic conditions, it is possible to organise continuous year-round production. Moreover, the choice of starting plant stock makes it possible to predict the fruit size upon harvesting; generally larger for industrial applications.

The sprouts are harvested when they reach between 350 and 550 g. They are sorted by 100 g categories, to bear fruits of staggered size, with the lighter sprouts bearing smaller fruits than heavier sprouts. After planting on a prepared soil with a basal dressing suited to local conditions, sprout growth is boosted by additional fertilisers and parasite monitoring.

Treatments and weed control are applied as necessary. After 6 to 7 months' growth, pineapple plants undergo a specific treatment, floral induction treatment (FIT). This artificially triggers flowering, and therefore fruit-bearing. Hence all the plants in a plot can flower and bear their fruit uniformly, in order to meet market demand. 5 to 6 months after FIT, fruits of equivalent size and a similar degree of maturity can be harvested. FIT is applied with three different, although fairly similar, products. They are applied by spraying or depositing the treatment solution on the plant core where the flower bud will develop. One or more applications will be required to ensure full effectiveness. The products used are: acetylene, a product of mixing water and calcium carbide (formerly used for miners' lamps), ethylene (a pressurised mixture of ethylene gas and activated carbon) and ethephon, a synthetic product releasing ethylene. In order to ensure uniform fruit coloration upon harvesting (approximately 150 to 170 days after TIF), the fruits are generally re-treated. An ethephon spray is applied approximately ten days before cutting. This degreening treatment promotes the development of yellow-orange coloration of the fruit skin, but it does have drawbacks. It is ineffective if applied during the rainy period, since the active ingredient could be leached.

Premature application in terms of the physiological development of the fruit is also counter-productive, since it disrupts the coloration/maturity relationship, a major criterion in consumer purchases.

Harvest and transport

The harvesting is most often manual. The harvesters pass between the rows and pick the fruit either by breaking the stalk or cutting it with a cutting tool. The fruits can be placed into harvesting crates or types of backpacks fitted with cells able to house each individual fruit. At the end of each row, they are loaded onto trailers and driven to packing stations. An antifungal treatment is often applied on the cut stalk to prevent any mould development.

On the large Central American plantations, the harvest process is more mechanised. A suitable vehicle is driven down the rows, and the pickers follow a particular line, picking the fruit and placing it on the tractor conveyor which takes the fruits to the plot edge. They are put in wooden palloxes containing approximately 2.5 tonnes, which are then forwarded to the packing stations or processing factories.

The more traditional facilities generally pack the fruit at the plot edge, in boxes of different sizes (6 to 12 fruits).

Transport by air-freight

This merchandise is grouped together and transported to the airport, loaded onto air pallets and shipped to the recipient markets.

In the hands of the importers, the fruits are sold directly to the distribution sector purchasing centres or to wholesalers.

Transport by sea-freight

The circuit followed by sea-freight pineapples is a bit longer. They go from harvest to the packing stations, where they are generally washed and packed by size. They are then palletised and pre-cooled to lower the core temperature and ensure better conservation, given the longer transport time. The pallets are transported to the shipping port and loaded directly onto polythermal ships or into refrigerated containers. Upon receipt, the fruits are transported to the importer's premises, supermarket purchasing centres or directly to the end customer.

1.3. Varieties, quality standards, classification

Varieties

There are numerous pineapple varieties derived from the different groups. Each group contains more than ten varieties or cultivars, with different distributions across the intertropical zone depending on their production characteristics, linked to the local pedoclimatic conditions.

The most widespread cultivars in commercial cultivation for the fresh or processed sector are limited to a few types. The **Smooth Cayenne** accounted for the majority of worldwide production in the latter half of the 20th Century. Its high yields, its good conservability, its cylindrical shape, the small amount of spines and its good organoleptic qualities long made it the prototype mass market pineapple. Conversely, its sensitivity to black spots, *Phytophthora* and soil parasites requires close crop care.²

In the late 1980s, a new natural hybrid variety derived from the research programme of the Pineapple Research Institute in Hawaii, appeared. Farmed from the early 1990s by Del Monte with the name **Extra Sweet or MD2**, it genuinely revolutionised the pineapple sector, causing a deep and lasting transformation. This semi-spiny variety established itself thanks to its very good yields, its low sensitivity to black spots and soil parasites, and its exceptional conservability. Its mild sweet flavour, very popular among consumers, would end up taking it to the top of the varieties produced for commercial purposes. Its only drawback lies in its high sensitivity to *Phytophthora*.³

Both Smooth Cayenne and Extra Sweet form the bulk of pineapple trade. Though the range is enriched by some additional varieties transported by air-freight and that occupy commercial niches.

- The **Queen Victoria**, belonging to the Queen group, is a small, spiny pineapple prized for its organoleptic qualities. This variety has a restricted range, with its main production zone in the Indian Ocean (South Africa, Mauritius, Reunion), and is exported fresh to Europe. Though fairly productive, it is sensitive to black spots, *Phytophthora* and soil parasites.

²PIP- Coleacp (2011), Pineapple Cayenne, crop production protocol. <http://pip.coleacp.org/en/pip/31144-production-guides>

³ PIP- Coleacp (2011), Pineapple MD2, crop production protocol. <http://pip.coleacp.org/en/pip/31144-production-guides>

- Finally, a new variety has been exported to Europe for several years. This is the **Sugarloaf** or “**bottle**” pineapple, similar to the better known Pernambuco group in Brazil. This type of pineapple is named for its shoulder-less shape. It has a lighter flesh than the others, almost white in colour and is prized for its sweetness and flavour. It comes mainly from West Africa (Benin and Togo).

The varieties cultivated for processing are highly restricted. **Champaka**, which produces large fruits, is preferable to the Smooth Cayenne, which is still used in some countries. For several years varietal modifications have been observed in the production sector for processing. As on the fresh market, the MD2 variety is spreading, particularly to the detriment of Champaka, and especially in Asia.

Quality standards

There are several pineapple quality standards. The Codex Alimentarius international standard was developed by a joint programme uniting the World Health Organisation (WHO) and the United Nations Organisation for Food and Agriculture (FAO). The pineapple standard of the Codex (Stan 182) was adopted in 1993, revised in 1999 and amended in 2011. It lists the various aspects of quality that pineapples (*Ananas comosus*) intended for the fresh market must meet. The quality aspects are set out as follows:

- Provisions concerning quality:
 - Minimum requirements,
 - Maturity requirements.
- Classification:
 - Extra class,
 - Class I,
 - Class II.
- Provisions concerning sizing
- Provisions concerning tolerances:
 - Quality tolerances:
 - Extra class,
 - Class I,
 - Class II,
 - Sizing tolerances.
- Provisions concerning presentationmn
 - Uniformity,
 - Packaging,
 - Description of containers
- Marking or labelling:
 - Packaging intended for the end consumer:
 - Nature of produce,
 - Packaging not intended for retail:
 - Identification,
 - Nature of produce,

- Origin of produce,
- Commercial characteristics,
- Official inspection marks.
- Contaminants
- Hygiene

This normative text, drawn up by experts from producer/exporter countries and importer countries, establishes a common terminology in commercial transactions. This text is applicable by United Nations member states whose governments have ratified it. The Codex Alimentarius has also drawn up a standard for canned pineapple (Stan 42, adopted in 1981 and amended in 1987)⁴. This text governs the presentation (whole, sliced, tidbits, crushed, etc.) and packing of canned pineapple. It also defines the authorised packing media and additives which can be used. The canned pineapple standard refers to a set of Codes of Practice recommended for processed products.

The Agricultural Standards Unit of the Trade and Timber Division of the United Nations Economic Commission for Europe (UNECE) also draws up standards for fruits and vegetables. The object of these texts is to facilitate international trade, promote production of high quality products, and safeguard consumer health. They are aimed at producers, traders and inspection authorities. This organisation has drawn up a standard concerning the marketing and commercial quality control of pineapples. Adopted in 2003, it was revised in 2012 with a view to harmonisation with other existing texts on the product. It has more or less the same scheme and criteria as those of the Codex Alimentarius standard, except for the contaminants and hygiene aspects specific to the Codex standard. UNECE has also drawn up a standard concerning the marketing and commercial quality control of dried pineapples, adopted in 2014 and listed under reference DDP-28⁵. Besides its standardisation work, UNECE produces interpretative brochures for the standards. There is one for the pineapple, published in 2013⁶ that is a precious guide for fruit quality control personnel and

⁴ Codex Alimentarius, (2015). CODEX STAN 41-1981, Standard for Canned Pineapple. <http://www.codexalimentarius.org/standards/list-of-standards/en/?provide=standards&orderField=fullReference&sort=asc&num1=CODEX>

⁵ UNECE, (2015). Dry and dried produce standards. <http://www.unece.org/trade/agr/standard/dry/ddp-standards.html>

⁶ UNECE, (2013). Pineapples, explanatory brochure. http://www.unece.org:8080/fileadmin/DAM/trade/Publications/ECETRADE_398E_PineappleBrochure.pdf

enables interpretation of the text for each quality criterion dealt with. Visual images facilitate the implementation of the standard, by clearly designating the acceptability thresholds for a given qualitative defect.

There is no European Union standard on the pineapple. However, as for any product imported into the Community, a framework standard applies. This boils down to requiring the product to be of sound and merchantable quality. Regulation EC 1221/2008⁷ makes it possible for the Official Services of the European Union to inspect an imported product, based on the UNECE standard, if any (which is the case for the pineapple), provided that the packaging is marked with or refers to elements from the UNECE standard. The product will in this case be deemed to have implicitly opted for this standard. The lack of stringency of the standards in force (Codex or UNECE) does not exempt the pineapple from qualitative requirements. They will be drawn from the private sector, such as specifications or certifications.

1.4. Use

The pineapple is consumed **fresh** as a dessert, but also as part of numerous compositions such as fruit salads or in exotic cuisine.

- The **processed** pineapple too has a big sized market. The most widespread form is canned, in which the pineapple presentation ranges from whole slices to segments. Canned pineapples also vary in terms of additives they contain, from plain pineapple juice to sugar syrup, of varying density. It is also part of canned fruit compositions. The pineapple is also present on the processed segment as cut fresh fruits packed in sachets or punnets. Jams and fried segments, which provide a longer lifetime.
- Plain or concentrated **juices** also represent a common use of the fruit. Here too the product can be found on its own or mixed with other fruits. The containers used include bottles, jars, cans, Tetra Packs and aluminium sachets. Fermented pineapple juice is used for wine and vinegar.
- The food industry produces **semi-processed purées** or frozen fruit segments used in

particular for dairy products (yogurt, ice-cream, etc.).

- **Dried and/or crystallised** pineapples are also manufactured for direct sale in slices, in plain segments, or in mixtures (e.g. “apérifruits”, etc.).
- Bromelain, an **enzyme extracted from the pineapple**, is being researched in particular for the pharmaceutical industry. It appears to be a digestive facilitator.
- Finally, further upstream in the industry, **pineapple leaves** can be used as a livestock feed component, by the paper industry or for making rope fibres. The oil cakes derived from the industrial segment are also useful by-products for green fertiliser and compost, but also livestock feed. Fermentation of these oil cakes enables biogas production.

1.5. Diseases, pests

Main diseases

Phytophthora is a fungal disease attacking both the plant and fruit. It damages the roots and spreads to the leaves which change colour from green to yellow, and then pink-red. They change shape, curving, with the tips bending toward the ground. The rot can also reach the core of the plant, the inflorescence and even the young fruit. Several types of pathogenic fungi are responsible for the infestation and blight of the plant and fruit. The most acidic soils seem less favourable for the development of these pathogens. They proliferate in wet environments, especially poorly drained soils. Chemical management by contact or systemic fungicide is a possibility. The main problem remains identifying the problem, since it first attacks the roots, which are invisible without uprooting the plant⁸.

Ceratocystis paradoxa diseases. They attack the above-ground part of the plant, with the fungus developing in form of a rot on unscarred wounds. They also affect sprouts, as well as injured fruits: a soft stem rot, white spots on the leaves, soft watery rot on the fruit stalk, or around bruising on the fruit body. The fungus rapidly develops in a warm, wet atmosphere. Chemical management can mitigate the development of the disease, but cultivation and harvest organisation can also counter the development of the disease by reducing fungus entry zones (bruising and injuries).

⁷ Official Journal of the European Union (2015), Commission Regulation (EC) N° 1221/2008. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:336:0001:0080:en:PDF>

⁸ PIP- Coleacp (2011), Pineapple MD2, crop production protocol. <http://pip.coleacp.org/en/pip/31144-production-guides>

Penicillium sp and Fusarium sp. These fungal disease mainly affect the fruit. Dark yellow or brown to black spots develop inside the fruit. In many cases, there are no external symptoms indicating infestation. This often occurs during flowering, but can also develop as the fruit matures. Mites and scale insects may be transmission vectors of these internal alterations in the fruit. Infestations also seem to be seasonal, following a dry period preceded by a wet period. Scheduling the harvest in line with climate swings and management of any vectors limit the propagation of the disease.

"Wilt" disease. Due to a virus and linked to feeding by scale insects, it affects the roots and then the leaves, which gradually change colour and wilt, turning beige or exhibiting yellowish spots. The plant blight leads to a fall in yield of as much as 50 %. Biological management is a possibility using certain varieties of Coccinellidae. Chemical management of scale insects which are infestation vectors is also used. Clearing up plots, removing any plant debris favourable for the development of vector insects, and disinfecting planting stock are also recommended⁹.

Pests

Nematodes, which are small worms, are present in all soil types. Like other micro-organisms, they are involved in the organic matter cycle. These organisms mainly attack the plant roots without any particular symptoms, and can cause a substantial fall in yield. Attacks may be identified by the appearance of non-uniform plant growth within a plot. The leaves turn yellow, pink and red, signifying deficiency in nutrients and water. There are numerous nematode species for the different production regions and their pedoclimatic conditions. There are four species which really affect the pineapple. Nematodes are difficult to manage. Certain cultivation methods can reduce the parasite pressure, such as bare fallow or fallow planted with poor nematode host plants. Soil disinfection using nematicide may also considerably reduce populations. Combining the two processes achieves useful results.

Symphylans are small pseudo-millipedes which feed on the pineapple root tips, disrupting nutrient absorption by the plant. The symptoms are identified by non-uniformity in plant development within a plot. The dryer the soil, the more severe the attacks. The damage depends on the infestation

period, and its frequency or repetition. Symphylans particularly appreciate young tissues. This gives rise to increased risks when planting sprouts with a still under-developed root system. Some predators of symphylans have been identified, but introducing them is still a tricky matter. Working the soil is a good method of limiting parasite populations. Chemical treatments are also a possibility upon planting (sensitive period), but also in mid-cycle.

Scale insects develop primarily on the plant's foliar system. Their multiplication causes reduced plant photosynthesis, thereby slowing down its growth. They can also be found on fruits, which degrades their commercial presentation. Insecticide treatments can successfully contain the proliferation of scale insects. Certain predators such as Coccinellidae can help limit parasite populations.

Mites, which are highly abundant on pineapple plantations, apparently reduce the rate of plant growth. In cases of major infestation, their presence is generally regulated by use of effective acaricides.

Weeds can easily propagate on pineapple plantations, especially during the first few months after planting, taking advantage of the soil between the rows. They compete with the pineapples, limiting their growth. In addition they are favoured hosts for many pests, such as nematodes, symphylans, scale insects, etc. Hence it is recommended to perform regular weeding.¹⁰

1.6. Environmental and social impacts

Environmental impacts

Like any large-scale plantation, the areas dedicated to pineapple cultivation have an impact on the natural environment. Many producer countries have a fruit sector comprising small producers whose plots remain modestly sized, and which have only a minor environmental impact. Conversely, the industrial production sector, which produces the majority of fruit aimed both at the fresh export and processing sectors, leads to major consequences on the environment.

Setting up vast plantations often requires deforestation or conversion of the cultivated area from its pre-existing state (forest, other crops, pastures, etc.). It disrupts the original biotype, significantly affecting local fauna and flora. It may harm the natural characteristics of the site, by soil depletion and erosion. Furthermore, the

⁹ Loeillet D., Paqui T., Balmer B. (2014). « Pineapple Close-up », Fruitrop, 228 : 18-57.

¹⁰ Loeillet D., Paqui T. (2013). « Pineapple Close-up », Fruitrop, 215 : 31-70.

construction of buildings and of a dense network of roads alter the space and landscape.

Water requirements are generally high in the case of establishing a large-scale intensive crop such as the pineapple. Irrigation and any water used on the packing stations monopolise the resources, at the expense of surrounding inhabitants and crops. Exploitation of water whether they come from natural flows or pumping, can break the ecological balance of the installation sites.

Frequent and abundant use of agricultural inputs required for pineapple cultivation, in the form of fertilisers or treatment products, also represents a considerable risk of pollution or ecological damage. These products are actually likely to contaminate the soils and water tables in the long term. There are frequent adverse effects on producers and local farmers, causing contamination of plant foodstuffs, but also affecting livestock growth. Several reports have described alterations and deterioration of rural environments in the biggest producer countries.

Social impacts

The social impacts caused by setting up a large pineapple plantation are multiple, contrasting or even contradictory. They are eminently positive and socially structuring since these structures require an

abundant workforce, insofar as despite genuine mechanisation, many tasks are still performed manually (planting, crop care, treatment, harvesting, packing, etc.). Hence they provide numerous permanent or seasonal jobs. In certain cases, they provide better living conditions for their employees, by building homes, schools, or even medical centres, providing land for food crops, etc.

Yet these improvements are often limited and undermined by the working and living conditions of the employees. Low wages for the work done, more or less direct barriers by the management to trade union and coercive systems are often denounced, including by certain international organisations. Moreover, regular and more or less intensive use of phytopharmaceutical products under variable safety conditions exposes employees to toxic substances which can damage their health. More insidious are the living conditions in a more or less polluted environment, which can also eventually cause serious diseases.

There are numerous environmental and social impacts, from the most positive to the most negative. So for the sake of greater impartiality, the modes of production and social organisation on plantations should be studied on an individual basis.

1.7. Nutritional qualities

Table 1. Main features and components per 100 g of edible foodstuff

Constituents	Average content		
	Fresh pineapple	Pineapple juice	Pineapple in syrup
Energy (kJ/100 g)	223	206	348
Energy (kcal/100 g)	52.6	48	81.9
Water (g/100 g)	85.8	86.3	78.6
Proteins (g/100 g)	0.4	0.3	0.4
Carbohydrates (g/100 g)	11	11.6	19.1
Fats (g/100 g)	0.2	< 0.1	
Sugars (g/100 g)	9.24	11.6	17.6
Fibres (g/100 g)	1.52	0.2	0.85
Minerals			
Sodium (mg/100 g)	< 5.67	1.1	< 2
Magnesium (mg/100 g)	19.8	13.8	11.3
Phosphorus (mg/100 g)	11	7.8	5
Potassium (mg/100 g)	170	133	105
Calcium (mg/100 g)	20.3	12.4	< 23.5
Manganese (mg/100 g)	2.02	1.2	0.92
Iron (mg/100 g)	0.225	0.225	0.22
Copper (mg/100 g)	0.076	0.04	0.0332
Zinc (mg/100 g)	0.667	0.08	0.0646
Selenium (µg/100 g)	0.28	1.1	< 0.005
Iodine (µg/100 g)	1.22	1	
Beta-carotene (µg/100 g)	38.5		40
Vitamins			
E (µg/100 g)	0.1	0.02	0.08
C (mg/100 g)	12	9.5	10.4
B1 (mg/100 g)	0.08	0.055	0.07
B2 (mg/100 g)	0.03	0.02	0.1
B3 (mg/100 g)	0.3	0.3	0.2
B5 (mg/100 g)	0.16	0.15	0.07
B6 (mg/100 g)	0.101	0.1	0.07
B9 (µg/100 g)	13.5	23	5.5

Note: ANSES. Ciqual Table, Nutritional Composition of foods, 2013 : <https://pro.anses.fr/tableciqual/index.htm>

Source: Anses, 2013 [French agency for food, environmental and occupational health & safety]

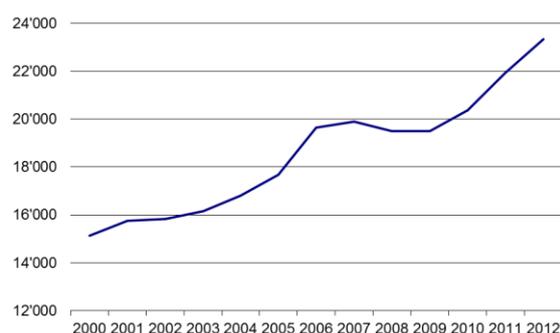
The bromelain contained in fresh pineapple is an enzyme with reported benefits, particularly as an antioxidant. There have been claims for its benefits as part of a weight-reducing diet, though this advice does not seem to be corroborated by serious scientific studies.

2. Supply

2.1. World production

According to FAO statistics, the pineapple is the eleventh most cultivated fruit, with just over 24.8 million tonnes produced in 2013¹¹. As illustrated in Figure 1, world's production is climbing steadily and has risen by more than 8 million tonnes between 2000 and 2013.

¹¹ FAOSTAT, 2015 : http://faostat3.fao.org/browse/Q/*E

Figure 1. World's pineapple production, thousand tonnes, 2000-2015

Source: FAOSTAT, 2015, FAOSTAT, 2015 :
http://faostat3.fao.org/browse/Q*/E.

2.2. Top 10 producer countries

The top ten producer countries, shown in Table 2, which represent nearly 74 % of world production, have changed little since the 2000s. Colombia, Mexico, China, the Philippines and India, have seen a constant production increase since 2000. However, the evolution has been more irregular for Thailand and Brazil, with a steep fall between 2006 and 2009, and growth resuming from 2010. Finally, Costa Rica, Indonesia and Nigeria, have been growing constantly and considerably between 2007 and 2010.

Table 2. Top ten pineapple producing countries, tonnes, 2014

Thailand	2 650 000
Costa Rica	2 484 729
Brazil	2 478 178
Philippines	2 397 628
Indonesia	1 780 889
India	1 456 000
Nigeria	1 420 000
China	1 000 000
Mexico	759 976
Colombia	551 133

Source: Fruitrop 2014

2.3. Exports

The top ten exporter countries account for 97 % of fresh fruits on the markets (Table 3).

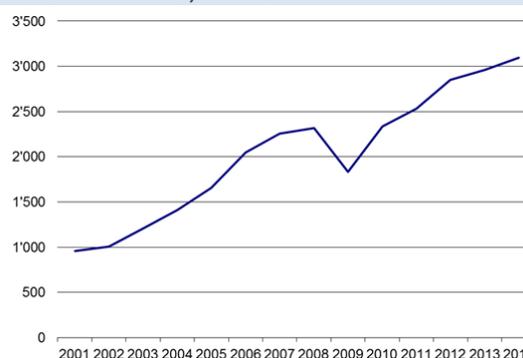
Just 3 million tonnes of fresh fruit are traded (Figure 2). On the one hand, the huge populations of China or India, for example, consume a significant part of the locally produced fruit. On the other hand, material requirements for processing units are significant, estimated at between 6 and 6.5 million tonnes (fresh fruit equivalent). Hence the proportion of fresh pineapples exported and of fruits

for processing amounts to between 9 and 9.5 million tonnes.

Table 3. Top ten fresh pineapple exporter countries, tonnes, 2014

Costa Rica	2 126 929
Philippines	461 856
Panama	67 038
Ecuador	57 380
Honduras	51 258
Mexico	41 271
Côte d'Ivoire	33 976
Ghana	33 175
Guatemala	25 091
Malaysia	23 585

Costa Rica stands out by virtue of its specialisation. The world number two producer is the leading exporter country since it sells nearly all of its production fresh, with the remaining aimed at the juice industry. Conversely, the Philippines only exports approximately 20 % of its production fresh, the remaining 80 % is mainly aimed at processing. Mexico is in a similar situation, though for considerably lower quantities. This means that the main producer countries, apart from Costa Rica, send their production for local consumption, and above all processing. This is the case with Thailand, the Philippines, Indonesia and China, which have a powerful hold over the processed products niche (jam, plain or concentrated juice) which dominates the Asian supply. Conversely, the main fresh pineapple exporter countries are in Latin America, and to a lesser degree Africa with Côte d'Ivoire and Ghana.

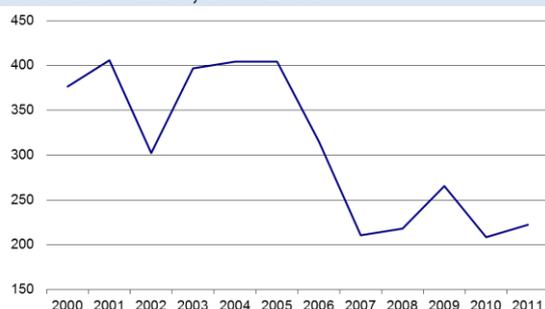
Figure 2. World fresh pineapple exports, thousand tonnes, 2001-2014

Source: Trademap, 2015 : <http://www.trademap.org>

The monthly exports from Costa Rica, by far the predominant source in terms of supply to the European Union, the United States and Japan, remain fairly stable due to the schedulability of production with quantities of around 150 000 tonnes/month. The same applies to the Philippines,

the main pineapple supplier to the Japanese market (Figure 5).

Figure 3. World pineapple juice exports, thousand tonnes, 2000-2011



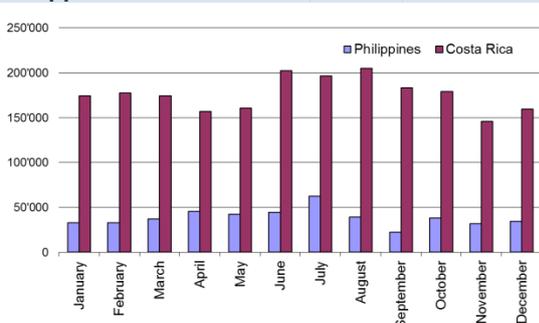
Source: Trademap, 2015 : <http://www.trademap.org>

Figure 4. World canned pineapple exports, thousand tonnes, 2000-2011



Source: Trademap, 2015 : <http://www.trademap.org>

Figure 5. Monthly pineapple exports from the Philippines and Costa Rica, tonnes, 2014



Source: Trademap : www.trademap.org

2.4. Factors affecting the supply

Meteorological phenomena (floods, droughts) and disease outbreaks can bring down the planned production. Yet these factors often remain limited to a region, with another one able to offset the shortfall.

Speculation around pineapple production, in particular the one for transformation, leads to production varying considerably. Hence, a fall in purchase prices for the producer because of high production will lead to disaffection of producers, and

therefore a fall in production the following year. A probable rise in rates will encourage producers to plant more. For example in Thailand, an abundant production in April/June 2012 led the government to set up an emergency fund for thousands of planters affected by the fall in purchase price : 4 THB/kg, up to 8 tonnes per producer, a long way off the 5 to 6 THB/kg paid in 2010 and 2011. In 2013, the situation improved, prices climbed back above the 5 THB/kg mark due to a fall in production. These fluctuations are less perceptible for fresh pineapples. However, pressure from volumes of fresh fruit of unequal quality has driven importers, in recent years, to favour certain sources to the detriment of others.

2.5. Prospects

The steadily ascending graphs of world pineapple exports and world imports, herald further development potential over the coming years.

Still under-developed markets such as Russia, Eastern Europe, the Near-East and Middle-East are all possible consumption reserves, provided that certain geopolitical constraints are lifted.

World production is able to meet further growth in fresh pineapple demand, since only 12 to 13 % of production is exported. The main limiting factor remains the price for potential consumers counterbalanced by the revenue for producers/exporters. In this respect, the development prospects seem more mixed. Small or modestly sized producers/exporters will have more difficulty cutting their margins in order to remain competitive in a context of generally rising costs of agricultural inputs and energy. The bigger facilities will find it easy to adapt to these constraints by economies of scale, and by means of financial operations. The general international context is vital, since it partly influences the economic results. Thus, while certain Latin American sources are on the wane due to lack of competitiveness, Costa Rica, the leading exporter country, is continuing its rise, offsetting the more or less marked decline of the neighbouring sources. However, the rebalancing of the euro/dollar exchange rate in recent months could eventually halt Costa Rican expansion, reducing the revenue of shareholders of the big companies dominating the sector.

The development prospects of the processed pineapple sector appear more complex given the fluctuations in purchase prices from producers. The less concentrated nature of the sector is more

favourable to competition between the main Asian sources sharing this niche.

3. Demand

3.1. Consumption, trends analysis

Demand for the fresh pineapple is concentrated in three main zones: North America, the European Union and Japan (Table 5). The other Asian

countries also represent considerable quantities. Conversely, non-EU European countries, Russia, the Near East, the Persian Gulf and Latin America are involved in distinctly smaller quantities. Of course, this breakdown excludes self-consumption.

Demand has seen a significant linear rise year on year throughout the past decade, a phenomenon practically unique in the fruit sector.

Table 4. Fresh pineapple monthly exports from Costa Rica, tonnes, 2013 and 2014

Month	2013				2014			
	Total, of which	USA	EU-27	Others	Total, of which	USA	EU-27	Others
January	133 441	60 624	66 420	6 397	161 942	84 383	71 183	6 376
February	142 055	64 738	71 010	6 307	160 480	77 191	76 735	6 554
March	185 436	97 773	82 588	5 075	202 144	104 544	92 550	5 050
April	172 461	81 778	86 293	4 390	199 313	108 547	86 319	4 447
May	188 916	97 994	87 141	3 781	215 329	113 763	95 937	5 629
June	141 661	73 929	65 041	2 690	168 028	91 263	72 752	4 013
July	148 980	78 263	67 070	3 647	176 869	92 746	79 131	4 993
August	149 955	78 596	68 374	2 984	142 550	77 563	59 817	5 170
September	154 807	86 175	64 670	3 962	171 773	98 096	67 237	6 439
October	172 292	93 557	72 265	6 471	170 206	92 539	69 245	8 422
November	176 030	84 241	79 161	12 629	0	0	0	0
December	173 762	83 676	84 900	5 186	0	0	0	0
Total	1 939 795	981 343	894 932	63 519	1 768 634	940 634	770 907	57 093

Source: *European and U.S. customs, 2014.*

Table 5. Main regional consumption centres, tonnes, 2009-2014

	2009	2010	2011	2012	2013	2014
North America	816 643	911 985	925 803	1 045 840	1 098 218	1 194 122
European Union	881 610	901 645	919 309	864 016	828 926	934 621
Japan	143 982	142 582	155 752	174 025	181 197	166 320
Other Asian countries	93 699	110 878	149 317	141 674	148 444	171 000

Source: *Fruitrop 2014. CIRAD (2014). Fruitrop n°228, p.18-57.*

Table 6. Monthly import rate, EU and USA, tonnes, 2014

	J	F	M	A	M	J	J	A	S	O	N	D
EU	68 288	70 500	77 680	89 924	93 597	78 913	81 891	64 264	64 240	71 261	66 836	107 225
USA	91 662	83 825	96 279	110 556	119 446	115 104	105 402	77 511	97 056	81 925	88 002	93 696

Source: *CIRAD (2014). Fruitrop n°228, p.18-57.*

Table 7. Pineapple — World production and imports, tonnes, 1969-2011

in tonnes	World production	Concentrated juice	Imports (fresh fruit equivalent)			Total imports
			Plain juice	Fresh pineapple	Canned	
1969-71 average	5 462 915	2	145 681	160 356	738 502	1 044 540
1979-81 average	9 775 626	3 042	342 317	365 493	982 024	1 692 877
1989-91 average	11 689 890	2 339 951	285 578	586 423	1 477 140	4 689 092
2004	16 797 344	3 343 733	446 632	1 708 440	1 887 802	7 386 607
2005	17 669 013	3 172 337	491 517	1 962 746	2 043 130	7 669 731
2006	19 640 457	3 475 653	528 528	2 291 837	2 220 693	8 516 711
2007	19 896 781	3 382 326	565 334	2 523 201	2 144 925	8 615 786
2008	19 485 024	3 709 206	660 873	2 634 601	2 257 449	9 262 130
2009	19 488 256	3 679 461	663 814	2 557 583	1 790 225	8 691 084
2010	20 334 422	3 407 460	615 571	2 714 371	1 790 263	8 527 666
2011	21 865 383	3 588 030	630 292	2 918 151	2 104 146	9 240 620

Sources: FAOSTAT and Cirad, 2014.

As Table 6 shows, the monthly import rates of fresh pineapple in the USA and the EU remains fairly stable from year to year, matching the schedule set up by Costa Rican planters, who produce and supply the bulk of the fruit to these markets.

Demand for processed pineapple is huge, yet more versatile than fresh demand due to the vagaries of production and price variation.

Concentrated pineapple juice forms the majority of imports, the figures for which are boosted by the nature of the product. It is a semi-finished product used by manufacturers in multiple applications, especially making fruit cocktails. Canning represents the second segment, with considerable variations in volume from year to year. However, the quantities of concentrated juice and canned pineapples are rising over the long term. While plain juice has a secondary position, its imports are growing steadily, probably manifesting a trend toward more natural products.

3.2. Top 10 consumers

Table 8. Top six pineapple importer countries, tonnes, 2011

United States	1 052 761
Netherlands	277 812
Japan	166 320
Belgium	148 224
Canada	126 258
United Kingdom	123 337

Source: CIRAD 2014. *Fruitrop n°228*, p. 18-57.

The consumption per capita is estimated at around 2 kg per year per inhabitant for North America and the European Union (EU-15), and approximately

1.3 kg/year/capita for Japan. These are substantial figures compared to those of the new EU Member States (0.44 kg) or Russia (0.18 kg). The low pineapple consumption in certain countries provides a glimpse of growth potential, which is all the greater since sale prices are increasingly accessible in view of the constantly rising supply. While the United States, Canada and Japan consume more or less the quantities that they import (excluding the minor re-export volumes), the same does not apply to the EU, where the Netherlands and Belgium are entry points distributing a large part of their imports across the other Member States. Thus, it is preferable to state an average consumption per capita for West European countries, rather than consumption per EU country.

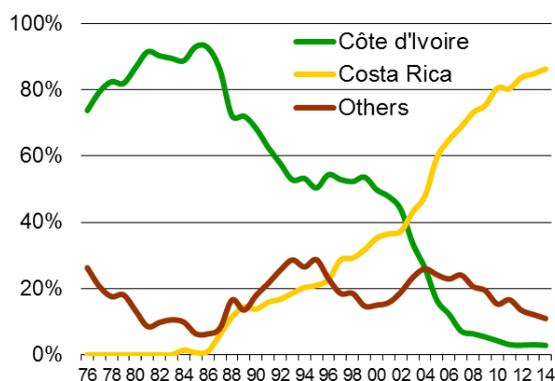
3.3. Imports

Fresh or processed pineapple imports are rising considerably over time, driven by an increase in production which promotes economies of scale, thus affordable prices.

The history of pineapple imports by Europe and the United States is particularly edifying and uncommon enough in the fruit sector to deserve special emphasis. The emergence of Costa Rica with the Sweet or MD2 variety in the 1990s seems to be a wave constantly breaking onto the markets. Sweet, tasty and boasting particularly good conservability, this variety within a few years replaced the hitherto predominant Smooth Cayenne. The rise of Costa Rica by means of transnational companies reconfigured the market structure within a few years, to the point of practically wiping out certain suppliers such as Côte d'Ivoire, the number one

supply source to the European market since the 1960s.

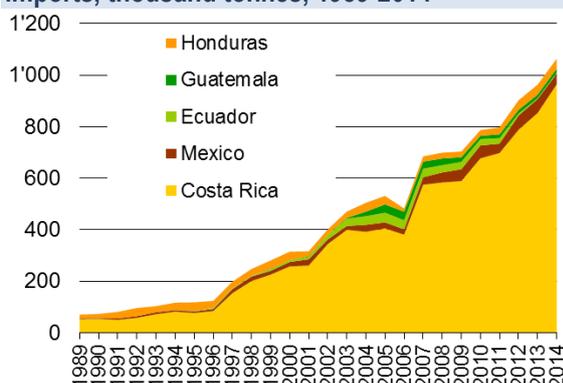
Figure 6. Fresh pineapple - EU market share by source, per cent, 1976-2014



Note: 2014: Estimated from the first 9 months

Source: Eurostat: <http://ec.europa.eu/eurostat>

Figure 7. Figure 1: Fresh pineapple - USA imports, thousand tonnes, 1989-2014



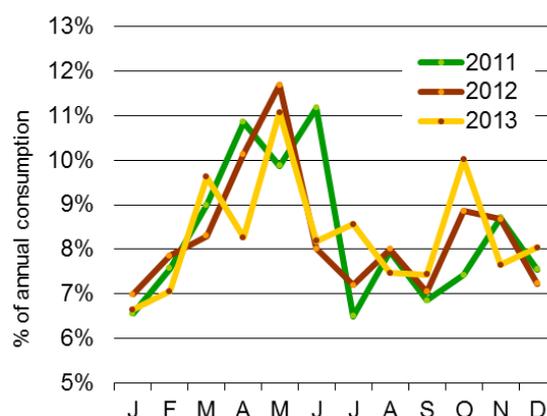
Source: US Customs <http://apps.fas.usda.gov/psdonline/psdquery.aspx>

3.4. Factors affecting demand

Given the regular imports flows, the sea-freight pineapple supply is most often greater than demand. Nonetheless, logistics are capable of disrupting the market conditions. Shipping delays (poor sailing conditions, more rarely delayed loading) are anticipated by operators, and contribute to sale price variation. This phenomenon is amplified at certain times of year when demand is higher. This situation is more marked for air-freight supply, which involves smaller quantities and is dependent on the freight capacities available in the exporter countries. In this case, air-freight represents a bottleneck liable to limit the supply, while demand is stable or high. Air-freight pineapple production is also more irregular, which can cause considerable variations in volume. Holiday periods, especially in Europe, are often accompanied by more intense demand, with consumption peaks at the end of the year or the Easter period.

Recurrent quality problems, in particular for air-freighted pineapple, can also influence the state of demand. At certain times of year, production is affected by the development of internal spots (during the shift between dry season and rainy season), which can eventually deter customers of a particular source. Professionals try to adapt their supply in line with these problems, yet no comprehensive solution has been found to eliminate this fungal risk.

Figure 8. Fresh pineapple monthly consumption, per cent of total, 2011-2013



Source: US Customs <http://apps.fas.usda.gov/psdonline/psdquery.aspx>

3.5. Prospects

The pineapple market is on the rise, the supply is in place and production is increasing in parallel, forming reserves for development. Scheduling of cultivation is an obvious asset, protecting against product shortage for both the fresh and processed sectors. Imports are also on the rise, alongside a consequent fall in prices in both countries already abundantly supplied, as well as those still with low consumption. Furthermore, purchasing power is increasing in many countries (emerging countries, Eastern Europe).

However, the rapid growth of Costa Rican cultivation and exports, which is so dominant on the fresh market, has been accompanied by a drop in prices on the recipient markets: while it promotes consumption, it also reduces producer revenue. The lack of profitability in several Latin American countries is resulting in a more or less marked dip in export volumes. Only Costa Rica seems to be defying these developments, and is continuing its rise. The exchange rate of the Costa Rican currency against the dollar or euro remains highly favourable, and is for the moment making up for the drop in sale prices, thus maintaining the growers' revenue, at least for large facilities. So the development prospects for the pineapple market appear to hang

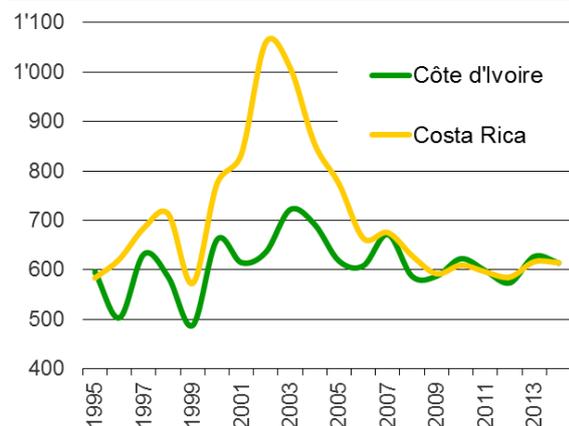
on the equation between sale price and exporter revenue.

The rise in volumes and proliferation of industry players, especially in Costa Rica, have led to a qualitative slump for the past few years, contributing to the commoditisation and devaluation of the pineapple. What orientations will Costa Rica operators take in the future? While the status quo could endanger this industry, a process of gradual restructuring seems more likely, based on reducing volumes and upgrading quality. However large facilities seem able to adopt this kind of development.

This scheme is not applicable to niche products, limited volumes of which come primarily from Africa. They are on a slow rise, in small proportions. The African countries also have a different environment, if only because of the currency parity of many sources with European countries.

4. Price

Figure 9. European Union stage price, euro/tonne, 1995-2013



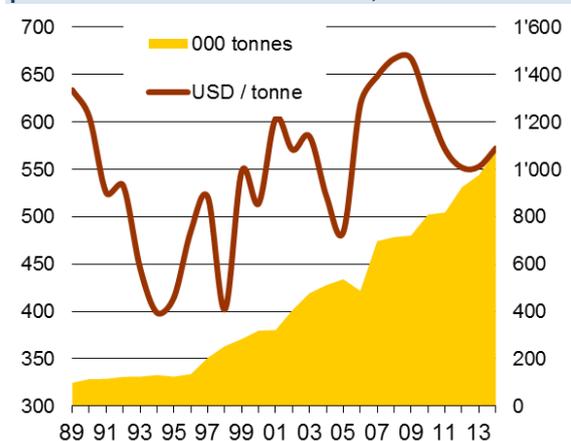
Source: Eurostat: <http://ec.europa.eu/eurostat>

For the past few years, fresh pineapple prices have tended to dip in European markets under the effect of the growing supply. The boom in the Costa Rican supply in the early 2000s, with the MD2 variety, first caused an increase in demand which was accompanied by a steep rise in prices, peaking in 2003. Thereafter, the increase in supply logically drove prices constantly downward until 2009/2010. For the past five years, prices have been more stable, but have seen fluctuations from year to year. The fluctuations during the 2013 and 2014 campaigns are attributable to variations in supply : fall in volumes on the market in July/August alongside a recovery in rates, as in November/December. Yet, unsuitability of incoming

volumes in terms of fruit size results in considerable price jumps. When the imports primarily comprise large fruits, prices come undone, whereas the less common small-sized fruits climb to higher price levels. The opposite is also observed at certain times of year.

For the US market, the price evolution seems distinctly more irregular as the market volumes increase. It took nearly twenty years of rate fluctuations for the price per tonne of approximately 600-650 USD in 1989 to reach this level again in 2009, while imports were multiplied by 2.5. Yet since 2009, the price curve has plummeted again, although it has recovered slightly in recent years, whereas imports have exceeded one million tonnes.

Figure 10. Fresh pineapple USA imports, USD per tonne and thousand tonnes, 1989-2013



Source: US Customs: <http://apps.fas.usda.gov/psdonline/psdquery.aspx>

Figure 11. Price of 65-degree Brix concentrated pineapple juice, USD/tonne, cfr Europe, April 2010-July 2013



Source: FOODNEWS : <http://foodnews.agra-net.com/>

Processed fruit rates are following more or less the same downward trend as for the fresh. The rate of concentrated juice (the majority of the processed pineapple market), has significantly lost in value

between 2010 and 2013, in spite of a timid recovery at the end of the period.

The niche air-freight pineapple market involves only limited volumes, estimated at around 10 000 tonnes for Europe. The price fluctuations are due to periods of higher consumption (e.g. end-of-year holidays), though also to the supply which remains sparse, and to the fact that there are several sources acting individually. Moreover, the recurrence of quality problems on fruits sold at certain times of year influences demand, and consequently prices. However, price variations remain limited to tens of euro cents.

4.2. Prospects

While import volumes have significantly increased over the past decade, prices have collapsed in parallel due to an imbalance between supply and demand, and to deterioration of the quality. The extraordinary receptiveness demonstrated by the consumer markets seems to have reached saturation. The pineapple is no longer satisfactory for consumers nor for producers who are seeing falls in their revenue. True, this revenue may be artificially inflated by exchange rate phenomena, but this situation cannot be sustained in the long-term. When an industry lives mostly on other financial revenues rather than those produced by its core activity, it is weakened by external factors over which it generally has little control. If Costa Rica aims at pursuing its growth in quantities, the source will sooner or later be faced with the problem of profitability. Conversely, greater moderation in

export volumes, seeking to better match supply to demand, and improving fruit quality could reverse the current trend of price deterioration.

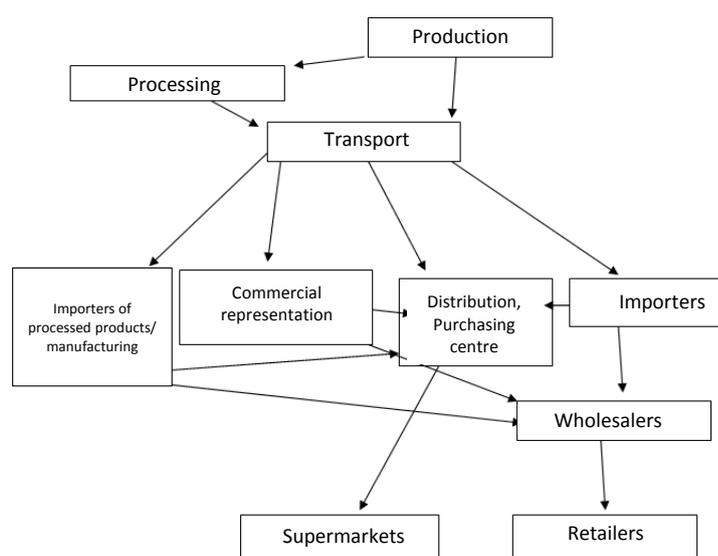
5. Market

5.1. Market structure

For the fresh market, transnationals most often have commercial representations in recipient countries or groups of recipient countries for their produce. Thus they integrate the entire circuit, from production to marketing. Some possess their own means of transport. This integration generally enables better control of quality, and a direct hold on recipient markets. With large volumes in their control, they will have favoured dealings with the big distribution groups. This market scheme encompasses the majority of pineapple volumes on the market. Independent producers that do not market their fruits via big groups, follow a short circuit, shipping their merchandise to an importer which will handle distribution of the fruit to the supermarket sector, but also to wholesalers. Some import companies are involved in production to better control product procurement and quality.

The processed produce market structure is different from the fresh produce market. Concentrated juices are reprocessed by manufacturers which repack them after mixing or diluting them to obtain a finished product. Marketing takes place downstream to the supermarket sector, but also to wholesalers.

Figure 12. Market structure



Source: The author.

5.2. Public / private standards

Public standards

Various texts set up by the public authorities of the consumption countries define the import system. They are regulations on phytosanitary problems, which aim to safeguard import zones against any introduction of harmful organisms including lists (insects, bacteria, viruses, etc.), the presence of which leads to rejection or destruction of the merchandise. These rules are managed by the USDA in the United States or by the European Commission for the European market. They are generally established under the aegis of dedicated international organisations. The same applies for the sanitary aspects aimed at governing use of agricultural inputs, and more particularly, the treatment products used for pineapple cultivation or post-harvest. These texts cover use of phytopharmaceutical products, their approval for marketing, but also their authorised residual contents for import, in order to safeguard consumer health and integrate lists of maximum authorised contents. Some countries have food health and safety regulations and regulations on organically grown produce. As the different countries are not subject to the same environmental pressures, the phytosanitary and sanitary rules are not necessarily the same. They may be harmonised in certain cases, though not systematically. Hence operators need to consult these regulations, via the competent services of the recipient countries.

Certain quality marks, such as labels or special designations for a production method or zone, may also be issued by the public authorities, like the French national label of quality recognition "Label Rouge" issued to Victoria pineapples from Reunion.

Private standards

The crises of the end of last century, such as BSE in Europe, and pressure from eco-lobbying have led certain economic sectors to draw up specific certifications for food products. Such certifications often originate from the distribution sector and aim firstly at exempting the distributors from penal liability, and consequently, providing a safety guarantee for the products. Based on a benchmark, such certifications reproduce and reinforce public regulations, often adding aspects on environmental and social issues. The best known are GlobalGap, BRC and IFS. These certifications, drawn up using the HACCP approach, are a prerequisite for entering the distribution sector of certain consumer

countries, but also enable better structuring of the fruit export and marketing entities.

The ISO standards, drawn up by the International Organization for Standardization, include two main series. ISO 9000 Quality Management System and ISO 14000 Environmental Management System. These standards can be implemented by companies to structure their manufacturing processes. They are more frequently implemented in the processed products sector, to ensure smooth process operation. These certifications are validated by specialised and approved independent bodies, which conduct regular audits of the entities undertaking this approach.

There are also a series of specific certifications pursuing a variety of objectives. They are issued by independent bodies. We can mention certifications governing fair trade, for example. Their aim is to improve the revenue of small producers of a particular type of produce.

5.3. Contracts

For the fresh pineapple trade, contracts between suppliers and recipients come in several forms. Transnationals or more modest-sized companies integrating production in their operations most often operate as a profit centre. Knowledge of cost price of the merchandise and cost control enables precise management of market fluctuations, though this remains governed by the rules of supply and demand.

Other contracts may be signed between suppliers and customers following a pre-established schedule based on fixed prices for the whole of a campaign, or by intermediate periods. This is the case in particular for big supermarket chains.

For niche products such as air-freight pineapple, there are fixed or commission sales contracts. The choice of contract form depends on the magnitude of the merchandise flow, and the trust between partners.

For processed products, the contracts are most often based on fixed contracts, but tied to world rates. Price fluctuations of processed products lead to long-term price negotiations. However, they can be revised depending on availability and competition from other produce, especially for plain and concentrated juice. In the case of fixed contracts, the transactions are governed by the incoterms in force, which specifically define handover of ownership of merchandise and the responsibilities of each player: sellers, purchasers, transporters, etc.

5.4. Niche markets

Niche markets for the pineapple operate in different ways. For fresh fruit, the most important is definitely the air-freight pineapple. It is estimated at around 10 000 tonnes per year in Europe, which makes it a substantial market if taken as a whole. Yet it remains piecemeal in terms of varieties and origin. Most of this market involves the Smooth Cayenne variety, which comes primarily from West and Central Africa (Benin, Ghana, Côte d'Ivoire, Togo and Cameroon). For a few years, Benin has diversified begun to export the Sugarloaf variety, volumes of which are growing though still marginal. Some Indian Ocean zone countries are shipping small quantities of Victoria pineapple, again aimed at Europe (Mauritius, Reunion and South Africa).

The other niche markets are turning to pre-processed products. The most artisanal form is illustrated by in-store cutting of fresh fruits. The fruit is cut by a specially designed machine, freeing the consumer from the tasks of peeling and cutting the fruit, often considered as brakes on consumption. They take away only the edible part of the fruit, packed in a sealed sachet. More sophisticated forms of processed products are also expanding the presentation range of the pineapple, such as fruit segments packed in a punnet, alone or in mixes. Cylinders of pineapple flesh are also available in plastic sachets, as a venture into the commercial segment of snacking. Yet as attractive as it may be, this range suffers from greater perishability than fresh whole pineapple.

In the field of processed pineapples, the main forms are dried and/or crystallised pineapples, mixtures of dried fruits, slices or segments of dried fruit sold individually or packed in sachets. This niche is developing slowly in the snacking or energy foods sector.

6. Regional/international trade

6.1. Top 10 exporters and importers

Table 9. Main export countries

Fresh pineapple	Canned pineapple	Concentrated pineapple juice	Plain pineapple juice
Costa Rica	Thailand	Thailand	Costa Rica
Philippines	Philippines	Philippines	Philippines
Panama	Indonesia	Costa Rica	El Salvador
Ecuador	Kenya	Indonesia	Thailand
Honduras	China	South Africa	
Mexico	Vietnam		
Côte d'Ivoire	Malaysia		
Ghana			
Guatemala			
Malaysia			

Table 10. Main import countries

Fresh pineapple	Canned pineapple	Concentrated pineapple juice	Plain pineapple juice
United States	United States	United States	United States
Netherlands	Germany	Netherlands	Netherlands
Belgium	Russia	Spain	Belgium
Germany	Spain	Italy	France
Japan	Netherlands	France	Germany
United Kingdom	Japan	Russia	Spain
Italy	United Kingdom	United Kingdom	United Kingdom
Spain	China	Belgium	Italy
Canada	France	Germany	Portugal
France	Canada	Japan	Czech Rep.

This table summarises the main sources supplying pineapple to the international trade. For the fresh pineapple, apart from the Philippines, exports come primarily from Latin America, and to a lesser degree West Africa. Processed pineapples in canned or concentrated juice form are the domain of Asian countries, and more particularly Thailand and the Philippines. Plain juices are divided between Asia and Latin America, with distinctly more modest volumes than for canned pineapple or concentrated juices, which represent the majority of processed pineapples.

While pineapple production and processing are based in Latin America and Asia, consumption is concentrated in North America and Europe. The main European recipient countries are characterised either in terms of entry points into the European Union, especially for fresh produce, or also in terms of major processing industries.

6.2. Top 10 trading companies

When we mention the biggest companies in the pineapple trade, a few names come to mind. These entities, frequently transnationals, can be found in both the field of production and trade. They include: Del Monte, Dole, Fyffes, Chiquita, Banacol, etc. These operators base their primary business on the banana. The pineapple supplements their product range by virtue of synergy with the banana, particularly in logistical terms.

6.3. Fairtrade initiatives

Since pineapple production is most often undertaken by big transnational groups, the Fairtrade approach, which is aimed more at supporting small producers, does not really have much scope for the time being. The range of tropical and subtropical products currently marketed under Fairtrade certification comprises the banana, citruses, avocado and mango. The Fairtrade approach might in future be applied to pineapples aimed at niche markets.

6.4. Trade issues (disputes, negotiations, agreements)

Given the magnitude of the merchandise flows for both the fresh and processed sectors, there are few disputes. The most common ones involve the fresh pineapple, with its high perishability. The damage most often encountered is often attributable to the mode of transport. While reefer shipping is generally well managed, thanks to high-performance polythermal ships, transport in refrigerated shipping containers does give rise to some incidents. A malfunctioning refrigerated unit can lead to qualitative deterioration of the merchandise. In this case, the recipient commissions a joint inquiry to determine the cause of the damage and its economic impact. Sea shipments are generally covered by insurance paying out for devaluation of merchandise in case of a proven incident during transport. For processed merchandise, the same often applies. An inquiry is commissioned in order to determine the reason for the damage. This may be due to the transport, but also to a manufacturing flaw. In either case, the insurance can compensate for economic losses. In rare cases, and if the surveys do not manage to determine the causes of the damage, or if they remain incompatible, the case may be referred to a commercial court, under the terms of the contract binding the various parties.

Conversely, air-freight shipments are rarely insured given the short transport time (governed by the Warsaw Convention). Disputes arising for this type

of merchandise are most often settled amicably between the supplier and customer, possibly after a survey. In case of disagreement during a dispute, the parties concerned may also appeal to an arbitration chamber to settle the dispute between them.

7. Useful links

7.1. Statistics

FAOSTAT: <http://faostat3.fao.org>

COMTRADE: <http://comtrade.un.org>

TRADEMAP: www.trademap.org

United States Department of Agriculture (USDA): www.usda.gov

Agricultural Marketing Service of USDA www.ams.usda.gov

European Commission: <http://ec.europa.eu>

7.2. International organisations and associations

www.codexalimentarius.org

<http://exporthelp.europa.eu>

<http://www.unece.org>

[www.oecd](http://www.oecd.org)

www.maxhavelaar.org

www.intracen.org

www.fairtrade.net

7.3. Latest news

For the past few weeks, the European Union has increased its monitoring of residual ethephon content on pineapples. This action arose after detection of residual ethephon contents greater than authorised levels (2 mg/kg) on Sugarloaf pineapple batches from Benin, and Victoria from Mauritius.

7.4. Related links

FRuitrop Magazine: www.fruitrop.com

FOODNEWS: www.foodnews.agra-net.com

Cole ACP: www.pip.coleacp.org